

# METHOD AND APPARATUS FOR A MICRO-ACTUATOR PROVIDING THREE-DIMENSIONAL POSITIONING TO A SLIDER IN A HARD DISK DRIVE

## ABSTRACT OF THE DISCLOSURE

The present invention includes a micro-actuator assembly. The micro-actuator assembly includes a planar micro-actuator and a vertical micro-actuator. The planar micro-actuator provides at least one planar micro-actuator arm for coupling to a slider. The vertical micro-actuator couples with the planar micro-actuator arm. The planar micro-actuator arm supports  
5 moving the slider in a planar direction. The vertical micro-actuator supports moving the slider, through the micro-actuator arm, in a vertical direction.

The planar micro-actuator may include two planar micro-actuator arms.

It is preferred that at least one of the micro-actuators include a piezoelectric device. The vertical micro-actuator preferably includes a bulk piezoelectric device for cost reasons. The  
10 vertical micro-actuator may include a thermoelectric device supporting vertical slider movement.

The invention includes manufacturing head gimbal assemblies, actuator arms, voice coil actuator assemblies, and hard disk drives. The hard disk drives, actuator assemblies, actuator arms, and head gimbal assemblies, are products of these processes.